

Claims

[c1] 1. A pre-crash sensing system for an automotive vehicle coupled to a countermeasure system having a countermeasure comprising:
object sensor generating an object signal, an object distance signal, object azimuth position signal and object relative velocity signal;
an object classifier coupled to the object sensor generating an object classification signal in response to the object signal; and
a controller coupled to said object sensor object classifier for activating said countermeasure in response to said object distance, object azimuth position, relative velocity and said object classification signal.

[c2] 2. A system as recited in claim 1 wherein said vision system generates an object signal, object distance signal, object azimuth position signal, and object relative velocity signal.

[c3] 3. A system as recited in claim 1 wherein said object classifier generates said object classification signal in response to at least one selected from a target vehicle ground clearance, tire profile, tire size, tire separation, number of tires, object size, cross-section contour, presence of a bumper, presence of front and rear license plates, front and rear lighting, front grill, operating front and rear windshield wipers, exterior mounted spare tire, side view mirrors, wheel well profile, steering wheel profile, human passenger profiles, rear axle and exhaust system.

[c4] 4. A system as recited in claim 1 wherein said object sensor comprises a vision system, a radar system, a lidar system or combinations of these sensor systems.

[c5] 5. A system as recited in claim 1 wherein said object size comprises height.

[c6] 6. A system as recited in claim 1 wherein said object size comprises object area and object height.

[c7] 7. A system as recited in claim 1 wherein said object size comprises width.

[c8] 8. A system as recited in claim 1 further comprising a vehicle speed sensor generating a speed signal corresponding to the longitudinal speed of the

vehicle; wherein said controller activates either a first countermeasure or a second countermeasure in response to the longitudinal speed signal.

[c9] 9.A pre-crash sensing system coupled to a countermeasure system having a first countermeasure and a second countermeasure, said pre-crash sensing system comprising:
object sensor generating an object signal, an object distance signal, an object azimuth position signal, and object relative velocity signal;
an object classifier coupled to the object sensor generating an object classification signal in response to the object signal; and
a controller coupled to said object sensor object classifier for activating said first countermeasure or said second countermeasure or said first and second countermeasures in response to said object distance, object azimuth position, relative velocity and said object classification signal.

[c10] 10.A system as recited in claim 9 wherein said object size comprises height.

[c11] 11.A system as recited in claim 9 wherein said object size comprises object area and height
12.A system as recited in claim 9 wherein said controller classifies said object and determines an object orientation in response to said object distance, said object size and said object height.

[c12] 13.A method for operating a pre-crash sensing system for an automotive vehicle having a countermeasure system, said method comprising:
establishing a detection zone relative to the vehicle;
detecting an object within the detection zone;
determining an object distance, object azimuth position and relative velocity;
determining an object classification; and
activating the countermeasure system in response to the object distance, object azimuth position, object relative velocity and classification.

[c13] 14.A method as recited in claim 13 further comprising determining an object size and wherein activating the countermeasure comprises activating the countermeasure in response to object distance, azimuth position, relative

velocity, classification, and object size.

- [c14] 15. A method as recited in claim 14 wherein determining object size comprises determining an object height; wherein activating the countermeasure system in response to the object size comprises activating the countermeasure system in response to the object height.
- [c15] 16. A method as recited in claim 14 wherein determining an object size comprises determining an object cross-sectional area; wherein activating the countermeasure system in response to the object size comprises activating the countermeasure system in response to the object cross-sectional area.
- [c16] 17. A method as recited in claim 14 wherein determining an object size comprises determining an object cross-sectional area and object height; wherein activating the countermeasure system in response to the object size comprises activating the countermeasure system in response to the object cross-sectional and object height.
- [c17] 18. A method as recited in claim 13 wherein detecting an object within the detection zone comprises detecting the object within the detection zone with a radar or lidar sensor system and confirming the presence with a vision system.
- [c18] 19. A method as recited in claim 13 wherein prior to the step of activating, choosing the first countermeasure or the second countermeasure or the first and the second countermeasures in response to said object size.
- [c19] 20. A method as recited in claim 13 wherein detecting an object comprises determining the vehicle orientation; wherein activating the countermeasure system in response to the object size, comprises activating the countermeasure system in response to the object size and vehicle orientation.